CLAIMS

1. A range finder device, for measuring, when a plurality of projected lights having radiation patterns whose light intensity differs three-dimensional space-wise are irradiated onto an object from a light source on a time-sharing basis to image-pick up reflected light of said projected light from said object with a camera, a distance using the light intensity of an image picked up,

characterized in that, with respect to each of a plurality of surfaces including the center of said light source and the center of a lens, there is obtained, in advance, relation between an angle of each projected light from said light source and light intensity in each surface,

characterized in that, at the time of actual distance measurement, light intensity of each pixel of said camera is measured, and on the basis of the light intensity thus measured, and relation between said angle and said light intensity on a predetermined surface corresponding to a coordinate position of said pixel measured, there is obtained said angle corresponding to said light intensity of the predetermined pixel thus measured, and

characterized in that, on the basis of these light intensity measured, said angles obtained and further

two-dimensional coordinate position information on said predetermined pixel on the image, a distance to said object is calculated.

2. The range finder device according to claim 1, characterized in that as said plurality of projected lights, there are two lights, and said projected lights are projected in different directions in a partly superimposed state position-wise with each other, and characterized in that relation between an angle of each projected light from said light source and light intensity is relation between the angle of each projected light from said light source and a ratio of each light intensity of said two projected lights at the angle.

3. The range finder device according to claim 2, characterized in that said projected lights are generated by arranging two light sources, each having a passive reflection plate provided behind said light source.

4. The range finder device according to claim 1 or 2, characterized in that light intensity of said image picked up is a differential value in image light intensity between when said projected light exists and when it does not exist.

5. The range finder device according to claim 1 or 2, characterized in that said object is irradiated at the same time with said plurality of projected lights,

reflected light of said projected light from said object is picked up with said camera, and said image thus picked up is made into an ordinary image.

6. The range finder device according to claim 1 or 2, characterized in that said camera is set to exposure time of less than a light emitting period of time of said projected light, whereby the influence of background light is suppressed.

7. The range finder device according to claim 1 or 2, characterized in that said

lens and said light source are arranged in such a manner that a straight line between said lens and said light source runs in parallel to the horizontal axis of an image pickup element surface.

8. The range finder device according to claim 2, characterized in that said plurality of projected lights are generated by a light source having a light transmission plate whose transmittance differs two-dimensionally provided forward thereof.

9. The range finder device according to claim 2, characterized in that said plurality of projected light is realized using such an optical element and a light source as to allow the light transmittance pattern to be switched.

10. The range finder device according to claim 3, 8 or 9, characterized in that light intensity of projected

light from said light source is measured in the absence of said passive reflection plate or light transmission plate to obtain a correction amount in advance, the light intensity is corrected using said correction amount at the time obtaining relation between an angle of each projected light from said light source and the light intensity, and at the time of actual distance measurement, light intensity measured is also corrected using said correction amount.

11. A range finder device, characterized by comprising:

a light source;

a first optical fiber for guiding light to be emitted from said light source;

light distribution means for dividing light guided by said first optical fiber into a plurality of courses;

a plurality of second optical fibers whose one end is connected to said light distribution means, for irradiating said light divided from an aperture at the other end thereof onto said object;

image pickup means for receiving reflected light of said irradiated light to acquire image data of said object; and

distance calculation means for calculating a distance to said object on the basis of said image data,

characterized in that intensity of light to be irradiated onto said object from said other end of each of said plurality of second optical fibers has distribution which is different on place.

12. A range finder device, characterized by comprising:

a light source;

a first optical fiber for guiding light to be emitted from said light source;

light branch means for dividing light guided by said first optical fiber into a plurality of courses to irradiate onto said object;

image pickup means for receiving reflected light of said irradiated light to acquire image data of said object; and

distance calculation means for calculating a distance to said object on the basis of said image data,

characterized in that intensity of light, in any of those courses, to be irradiated onto said object from said light branch means has distribution which is different on place.

13. A range finder device, characterized by comprising:

a plurality of light sources;

a plurality of optical fibers for individually guiding light to be emitted from said light sources on said object side to irradiate onto said object;

image pickup means for receiving reflected light of said irradiated light to pick up image data of said object; and

distance calculation means for calculating a distance to said object on the basis of said image data,

characterized in that intensity of light from any of the optical fibers to be irradiated onto said object has distribution which is different on place.

14. The range finder device according to claim 11 or 13, characterized in that there is provided a lens system arranged at the front of an aperture of said optical fiber for irradiating light onto said object.

15. The range finder device according to claim 11 or 13, characterized in that

in order to obtain distribution which is different on place of said light intensity, there is provided a light filter whose light transmittance differs depending upon the place at the front of the aperture of said optical fiber for irradiating said light.

16. The range finder device according to claim 12, characterized in that there is provided a lens system

arranged at the front of an aperture of said light branch means for irradiating light onto said object.

17. The range finder device according to claim 12, characterized in that

in order to obtain distribution which is different on place of said light intensity, there is provided a light filter whose light transmittance differs depending upon the place at the front of the aperture of said light branch means for irradiating said light.

18. The range finder device according to any one of claims 11 to 17, characterized in that said lens system is a collimator lens, a cylindrical lens, or a rod lens.

19. A camera for shape measuring or object extracting, having light-emitting means for irradiating an object with projected light having a specified radiation pattern, for picking up reflected light of said light-emitting means from said object to obtain a depth image using light intensity of the image picked up, characterized in that said camera has such a structure that a distance between said light-emitting means and an image-pickup lens is variable, and characterized in that the interval between said light-emitting means and said image-pickup lens can be taken sufficiently large during the use.

20. The camera according to claim 19, characterized in that such a structure that a distance between said

light-emitting means and said image-pickup lens is variable is realized by such a configuration that said light-emitting means and the main body including said image-pickup lens are relatively slidable, and during the use, said light-emitting means and said main body are caused to slide in such a manner that they are spaced apart from each other, whereby the interval between said light-emitting means and said camera lens can be taken sufficiently large.

21. The camera according to claim 19, characterized in that such a structure that the distance between said light-emitting means and said image-pickup lens is variable is realized by said light-emitting means and the main body including said image-pickup lens being connected together by a hinge configuration, and during the use, the hinge configuration between said light-emitting means and said main body is opened, whereby the interval between said light-emitting means and said camera lens can be taken sufficiently large.

22. A camera for shape measuring or object extracting, having light-emitting means for irradiating an object with projected light having a specified radiation pattern, for picking up reflected light of said light-emitting means from said object to obtain a depth image using light intensity of the image picked up, characterized in that

said light-emitting means has such a structure that shading plates each having a hole are arranged in front of each of a plurality of straight-line shaped light sources arranged, and each hole in the respective shading plates is deviated from each other position-wise, and said plurality of light sources emit light on a time-sharing basis.

23. A camera for shape measuring or object extracting, having light-emitting means for irradiating an object with projected light having a specified radiation pattern, for image-picking up reflected light of said light-emitting means from said object to obtain a depth image using light intensity of the image picked up,

characterized in that said light-emitting means is configured such that there is arranged, in front of one light source, a light modulation device whose light transmittance differs two-dimensionally and two-dimensional variation distribution of the light transmittance is switchable, and

said light-emitting means emits light plural number of times in response to switching of the distribution of the light transmittance.

24. A camera for shape measuring or object extracting, having light-emitting means for irradiating an object with projected light having a specified radiation pattern, for

image-picking up reflected light of said light-emitting means from said object to obtain a depth image using light intensity of the image picked up, characterized by comprising:

a plane display with a touch panel; and

when a plurality of points in an object are denoted by the user's touch operation while said picked-up image is being displayed on the touch panel, a distance calculation part for calculating an actual length between these points thus denoted from said depth image data.

25. A camera according to claim 24, characterized in that said distance calculation part calculates, from length information on each portion of said object obtained from said plurality of points denoted by the user, an area or a volume of the object.

26. A camera for shape measuring or object extracting, having light-emitting means for irradiating an object with projected light having a specified radiation pattern, for image-picking up reflected light of said light-emitting means from said object to obtain a depth image using light intensity of the image picked up, comprising:

a plane display with a touch panel; and

when a plurality of points in an object are denoted by the user's touch operation on the touch panel while said picked up image is being displayed on the touch panel,

a distance calculation part for calculating a diameter or a radius of a circle, or a length of a circular arc which passes said plurality of points denoted by the user from said depth image data.

27. The camera for shape measuring or object extracting, having light-emitting means for irradiating an object with projected light having a specified radiation pattern, for image-picking up reflected light of said light-emitting means from said object to obtain a depth image using light intensity of the image picked up, characterized by comprising:

object extracting means for extracting only an object which exists less than a distance denoted by the user, or only an object which exists within a range of a distance denoted by the user by using said depth image picked up.

28. The camera according to claim 27, characterized in that a portion taken for the background or foreground by a malfunction in said extracting process is denoted by touching said touch panel by the user, whereby said erroneous background or foreground extracting operation can be corrected.

29. The camera according to any one of claims 24 to 27, characterized in that the user inputs a coordinate using a pen type pointing device instead of operating said plane display with a touch panel with the finger.

30. The camera according to any of claims 24 to 27, characterized in that instead of operating said plane display with touch panel with the finger, a cursor for representing its position on an image is displayed on a normal plane display, and the user inputs a desired coordinate by operating a mouse or a push-button to thereby move the cursor position.

31. The camera according to any of claims 19 to 30, characterized in that a device for obtaining a depth image through the use of said image data picked up is capable of communicating with the main body including its image-pickup lens through communication means.

32. The camera according to any of claims 19 to 31, characterized in that said light-emitting means can be separated from the main body including said image-pickup lens, and characterized in that said light-emitting means is removed for use during normal video taking while during depth image picking up, said light-emitting means is mounted for use.

33. A camera for shape measuring or object extracting, having light-emitting means for irradiating an object with projected light having a specified radiation pattern, for image-picking up reflected light of said light-emitting means from said object to obtain a depth image using light intensity of the image picked up,

characterized in that said camera serves dually as a video camera capable of picking up a motion image to record it in a recording medium while said light-emitting means does not emit any light, and

characterized in that an index signal is added, to image data picked up when said light-emitting means emits light, and a depth image is calculated using only a specified image to which said index signal has been added.

34. The camera according to any of claims 19 to 33, characterized in that said camera is capable of generating also a color image at the same time in addition to said depth image to output both said depth image and said color image.

35. The camera according to claim 27, characterized in that said object extracting part extracts a color image for only an object which exists less than a distance denoted by the user, or only an object which exists within a range of a distance denoted by the user.